Business of Formal

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Business of Formal: A Tale of Two Perspectives

User perspective (project manager, engineering VP)

- Need for bringing formal technology in verification flow
- Availability of resources to apply formal
- Return on investment

EDA vendor perspective

- What's the right business model: products vs. services
- How to maximize the growth
- How to achieve, maintain, and increase profitability

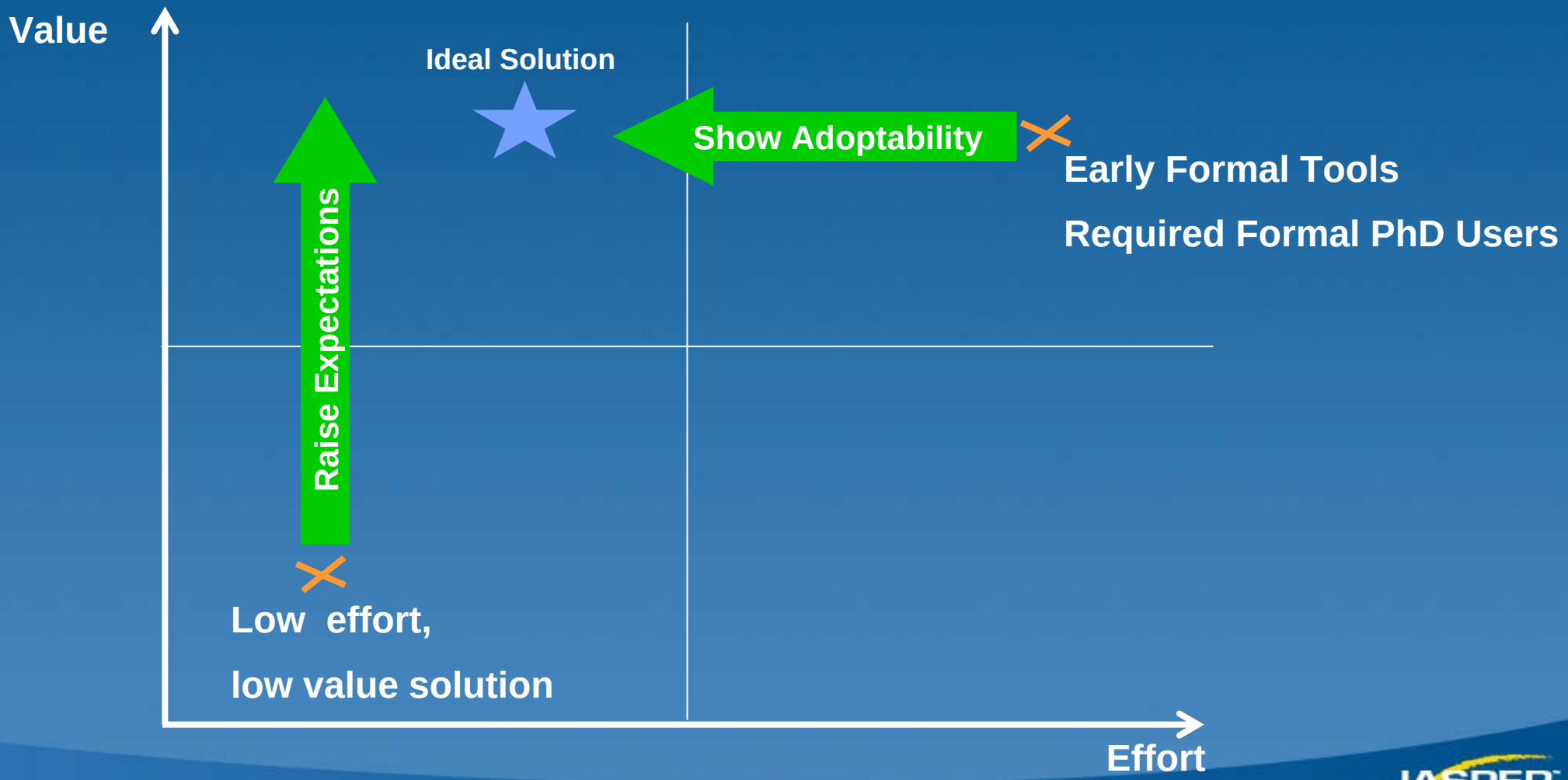
Prerequisites for Positive Formal Verification ROI

- Sufficient Potential Return
  - Are the properties that can be proven / verified by the formal tool important enough to merit using formal?
  - Will the expected results provide an overall productivity gain and/or quality improvement?
  - Can complex bugs be exposed?
- Predictable Resource Requirements
  - Can expected results be achieved within a predictable timeframe, with specified resources?

Recipe for *Negative* Formal Verification ROI:

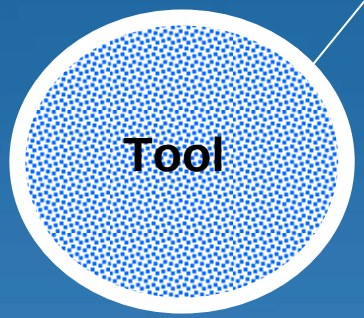
Haphazard use of formal verification – where results are left to the "discretion" (i.e. limitations) of the tool

Challenges in Building FV Market



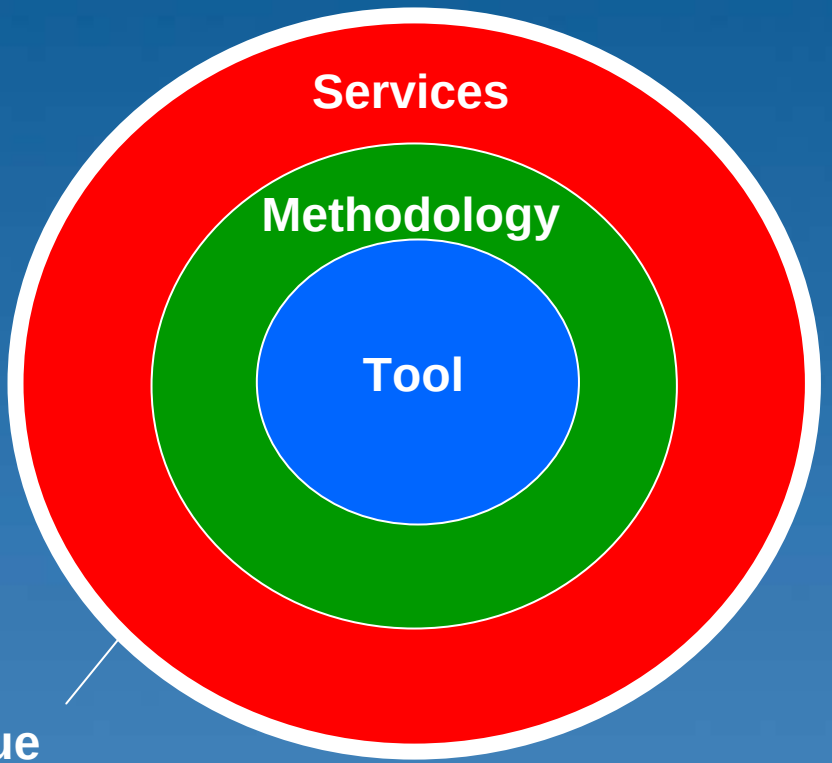
EDA Startup Alternatives

Low-Cost, Low Value Solution



<$100K Value to Customer

High-Cost, High Value Solution



>$1M Value to Customer

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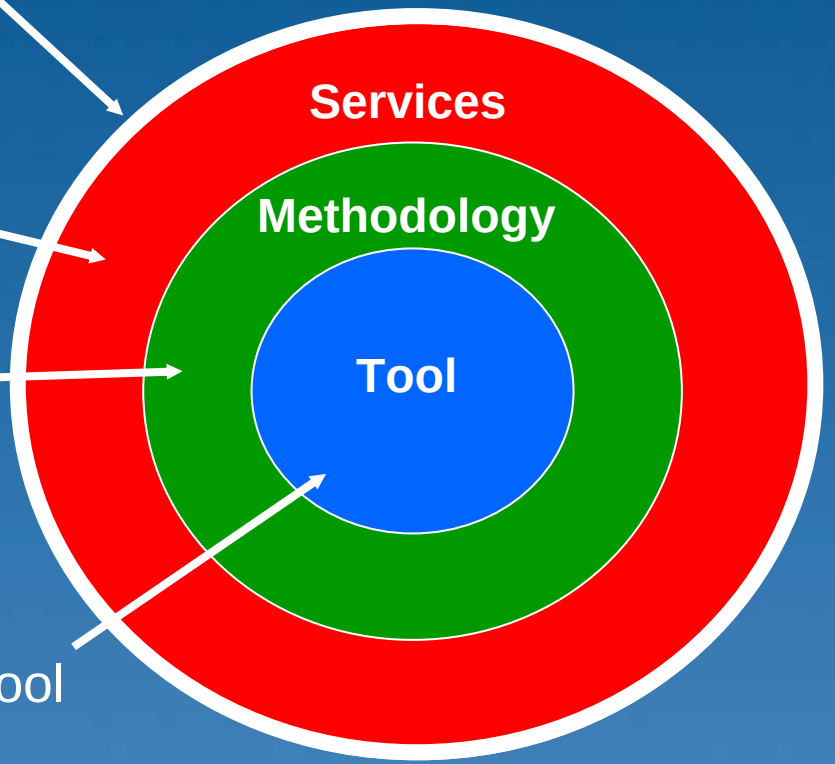
The Bulls-eye Strategy

Customers receive highest possible value

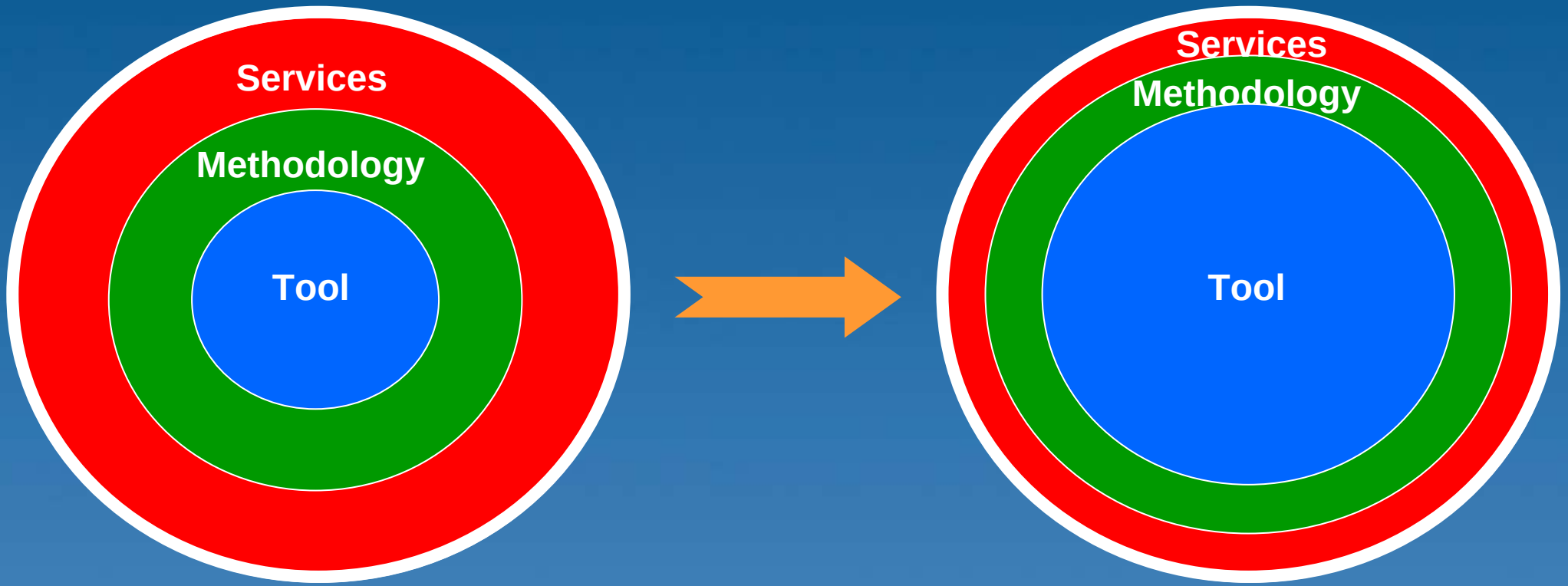
Direct exposure to real-world customer problems clarifies product direction

Service methods, once documented, become methodology steps

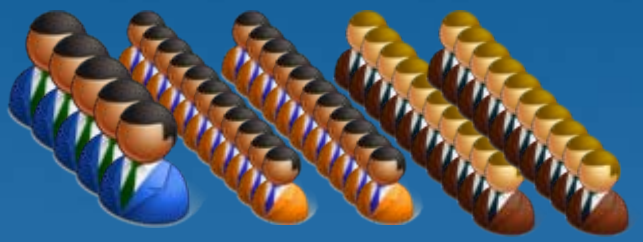
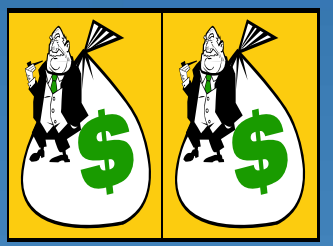
Predictable methodology steps, validated by use, are made into tool features



The Bulls-eye Strategy: Product Evolution



Current Status of Acceptance of FV Technology: An Illustration

Timeline	**2 years ago**	**Today**	**2 years later**
Proliferation			
	FE(2)	**FE(3)+DE(10)+DVE(10)**	**FE(5)+DE(20)+DVE(20)**
P.O. Amount			
Visibility			
	Manager	**VP**	**Multiple VPs**

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How can Academia Help the Business of Formal

- Reduce barrier to acceptance by producing “formal” savvy engineers:
  - Incorporate components of formal application in the course/project work
  - Designing with right level of modularity, proper interfaces
  - Ability to think of systems in terms of properties
- Continue progress on the biggest Achilles heel for formal – lack of predictability of results
  - Need technology AND methodology to bring predictability in the process
- Enhance the “R” of ROI from formal
  - Domain specific (semi)-automated formal techniques
  - (Semi)-automated techniques for property decomposition
  - Robust and scalable ways to leverage simulation infrastructure in formal analysis

How can Industry Help the Academia

- Make commercial formal products available to universities for course and project work
  - Issues to overcome: trade secrets, cost of support
- Make real industrial data (testcase, testbench, VCD) available for academia to benchmark against (possibly through a consortium)
  - An impossible dream?
- Provide opportunities for students to get some hands on industrial formal experience (internship etc)